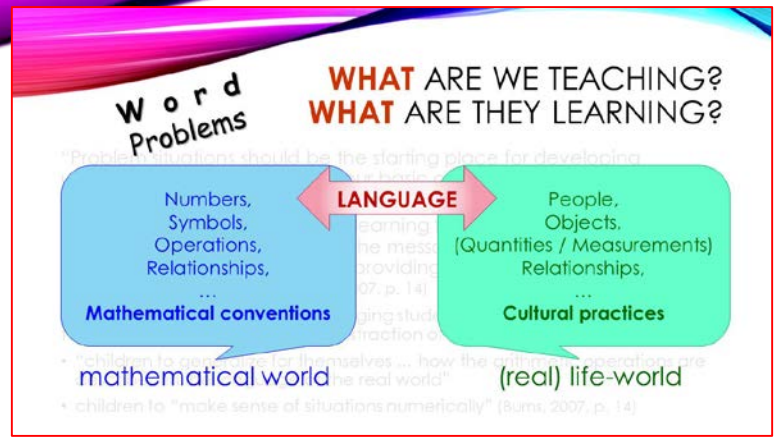
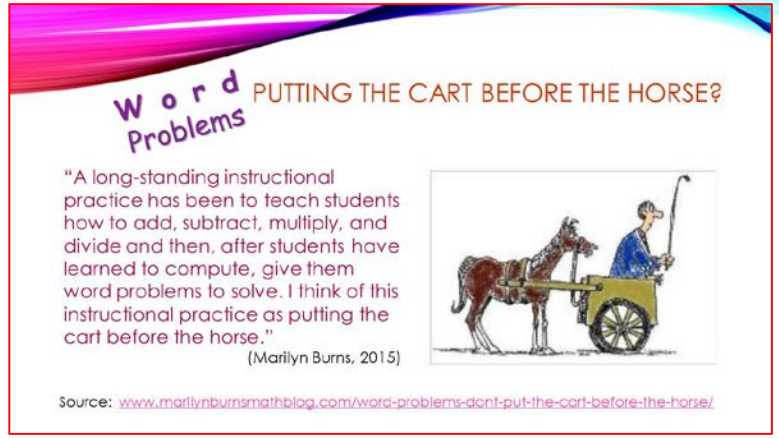
WORD PROBLEMS

a headache in our learning and teaching of mathematics, not least the classrooms with ethnic minority students

Ka Lok Wong

March 6, 2020





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a headache in our learning and teaching of mathematics, not least the classrooms with ethnic minority students

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March 6, 2020

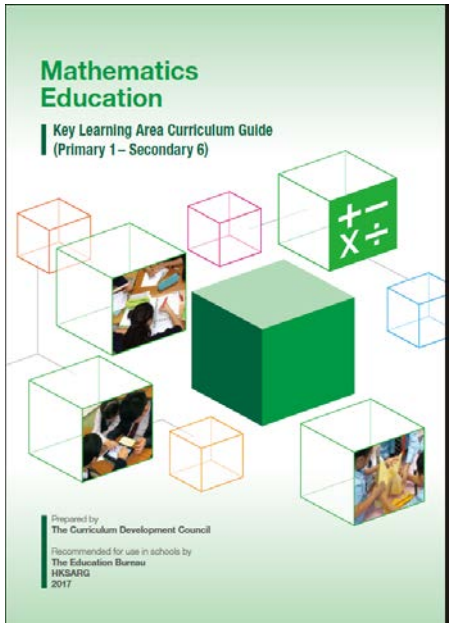
WHAT ARE “WORD PROBLEMS”?

- word problems?
- application problems?
- 文字題？
- 應用題？

WHAT ARE "WORD PROBLEMS"?

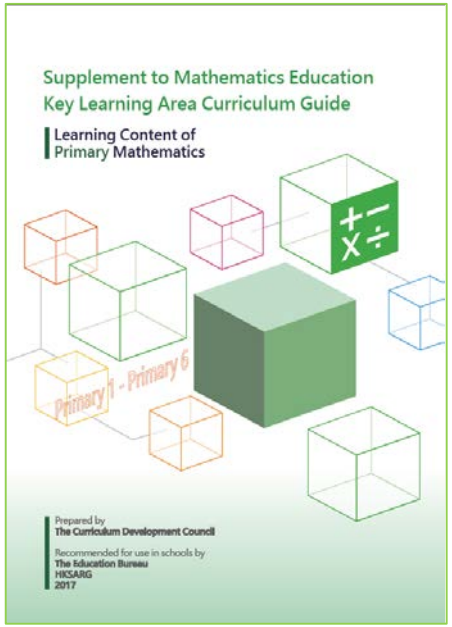
"文字題"
2 occurrences
"應用題"
28 occurrences

"word problem"
1 occurrence
"application problem"
1 occurrence



"文字題"
0 occurrence
"應用題"
61 occurrences

"word problem"
0 occurrence
"application problem"
0 occurrence



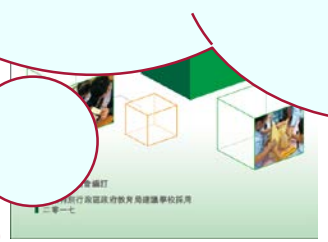
WHAT ARE "WORD PROBLEMS"?

- word problems?
- application problems?
- story problems?
- real world problems?
- …

- 文字題？
- 應用題？
- 故事題？
- 情境題？
- ……

Mainly concerned with …

- application
- "real-world" situations
- situations described in words
- solving problems
- problem solving



Is it a matter of simple translation?
文字題 = word problem(s)？

- a convention
- a practice
- a linguistic practice
- a cultural practice

DIFFICULTIES WITH WORD PROBLEMS

When your students tackle a word problem, what do you think are their major difficulties?

(You may choose up to 3 options.)

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When your students tackle a word problem, what do you think are their major difficulties?

(You may choose up to 3 options.)

- ☐ Reading ability
- ☐ Reading to understand the situation
- ☐ Familiarity with the situation
- ☐ Computation skills
- ☐ Choosing the correct operation(s)
- ☐ Deciding on when to do computation
- ☐ Connecting the meaning of operation(s) to the understanding of the situation
- ☐ It depends.

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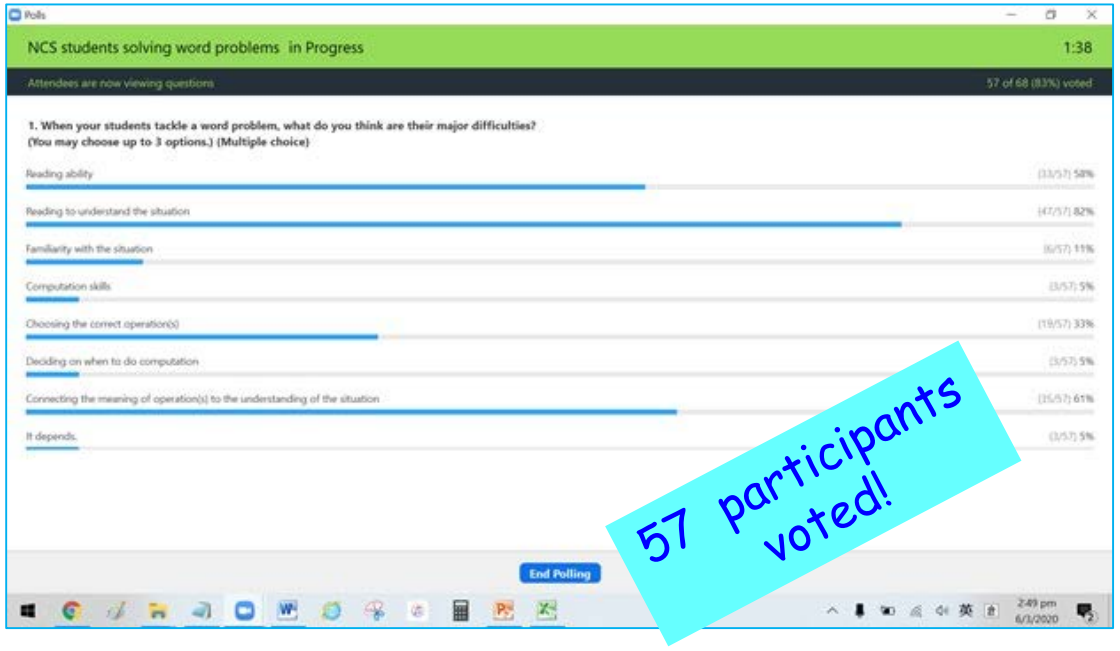
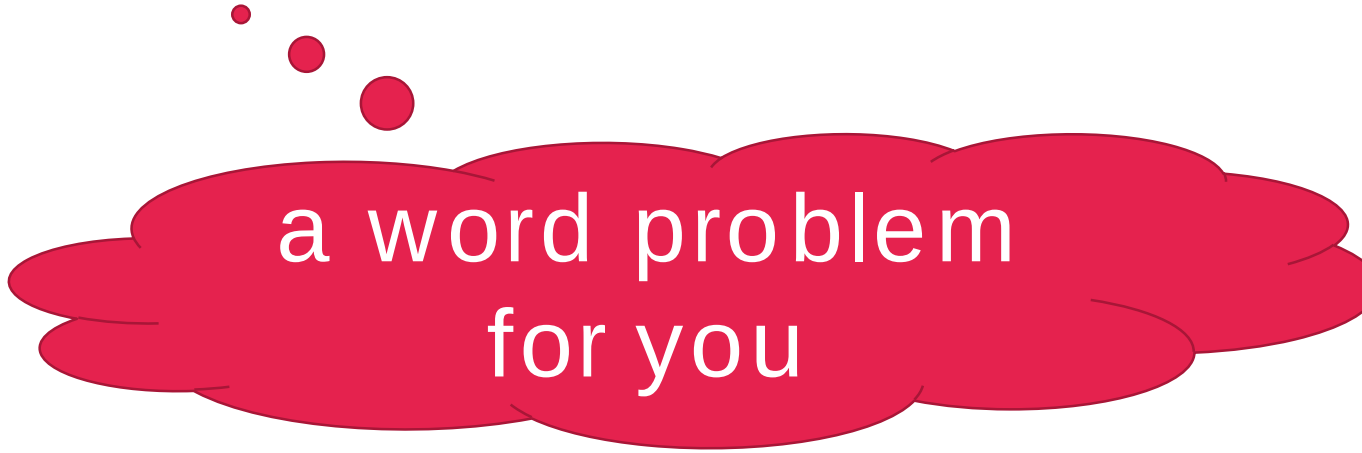


DEALING IN HORSES

A man bought a horse for $50 and sold it for $60. He then bought the horse back for $70 and sold it again for $80. What do you think was the financial outcome of these transactions?



DEALING IN HORSES*

A man bought a horse for $50 and sold it for $60. He then bought the horse back for $70 and sold it again for $80. What do you think was the financial outcome of these transactions?

- ☐ Lost $20
- ☐ Lost $10
- ☐ Came out even
- ☐ Other (describe _____)
- ☐ Earned $10
- ☐ Earned $20
- ☐ Earned $30

* This is a problem put forward in Burns (2007, p. 14).

DEALING IN HORSES*

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The scenario is easy to understand, although there are some less common words. The calculations involved are not difficult. "Yet deciding precisely what to do isn't obvious to everyone. The difficulty lies in knowing the correct way to connect the arithmetic operations to the situation in order to arrive at a solution." (Burns, 2007, p. 13)

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DIFFICULTIES WITH WORD PROBLEMS

Traditional sequence of teaching/learning:

Numerical symbols ➔ Computational skills ➔ Application problems

Difficulties arising from … ?

- Reading ability
- Reading to understand the situation
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- It depends.

We have come across or even tried **various strategies and approaches.**

However, do they all serve well my own understanding of the usage / purposes of “word problems”?

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Putting the cart before the horse?!
("backward approach")
(Burns, 2007, p. 13)

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Should we consider more seriously "Using word problems to develop arithmetic understanding"?

(Burns, 2007, pp. 13-15)

Word Problems

PUTTING THE CART BEFORE THE HORSE?

"A long-standing instructional practice has been to teach students how to add, subtract, multiply, and divide and then, after students have learned to compute, give them word problems to solve. I think of this instructional practice as putting the cart before the horse."

(Marilyn Burns, 2015)

Source: www.marilynburnsmathblog.com/word-problems-dont-put-the-cart-before-the-horse/

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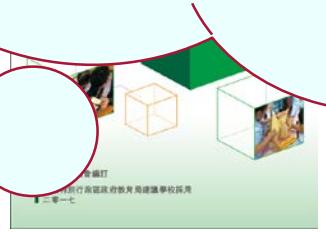

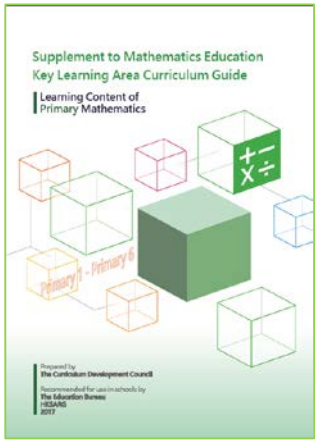

BASIC STANCE

"Problem situations should be the starting place for developing understanding of each of the four basic operations of arithmetic ... thereby establishing the need and context for computation skills.

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- Does it make sense?
- Does it work (in real classroom / curriculum practice)?
- **What is yours?**

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➔ Presenting / teaching / encouraging students to discuss (and find solutions to) word problems, "without the distraction of numerical symbols", develops …

- "children to generalize for themselves … how the arithmetic operations are described in the language of the real world"
- children to "make sense of situations numerically" (Burns, 2007, p. 14)

Word Problems

WHAT ARE WE TEACHING?
WHAT ARE THEY LEARNING?

Numbers,
Symbols,
Operations,
Relationships,
…
Mathematical conventions

LANGUAGE

People,
Objects,
(Quantities / Measurements)
Relationships,
…
Cultural practices

mathematical world

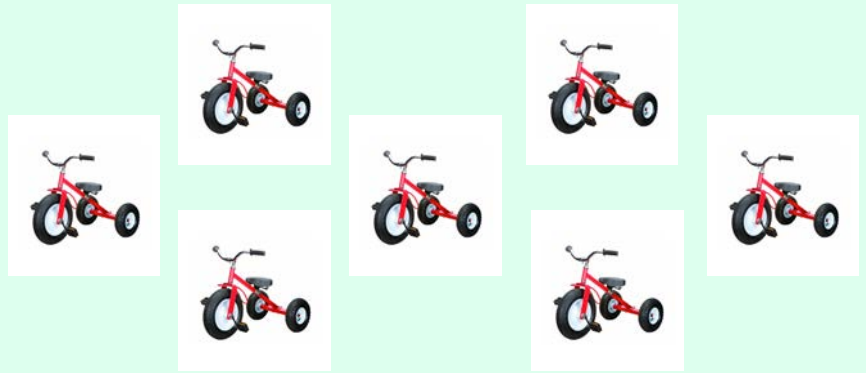
(real) life-world

WHAT ARE WE TEACHING?
WHAT ARE THEY LEARNING?

an example (considered by Burns, 2015)

There are 7 tricycles. How many wheels are there altogether?

$7 \times 3 = ?$



mathematical world

(real) life-world

Video-illustration of the lesson at YouTube: https://youtu.be/GElYcBzQIjU

Any ways to bring the mathematical symbols closer to the real world?

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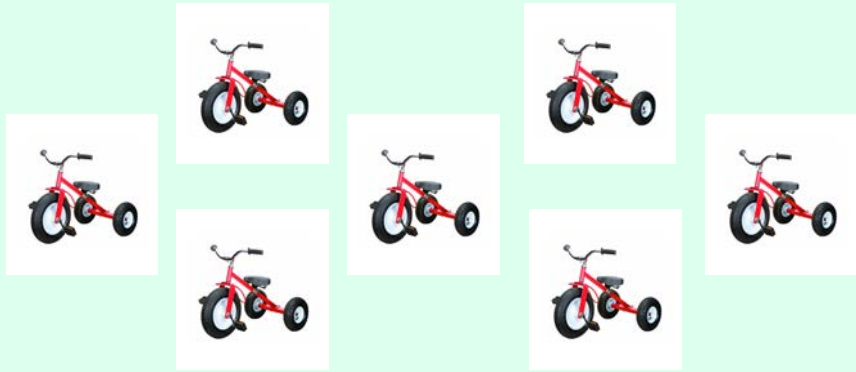

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Any ways to represent the real world by more mathematical conventions ?

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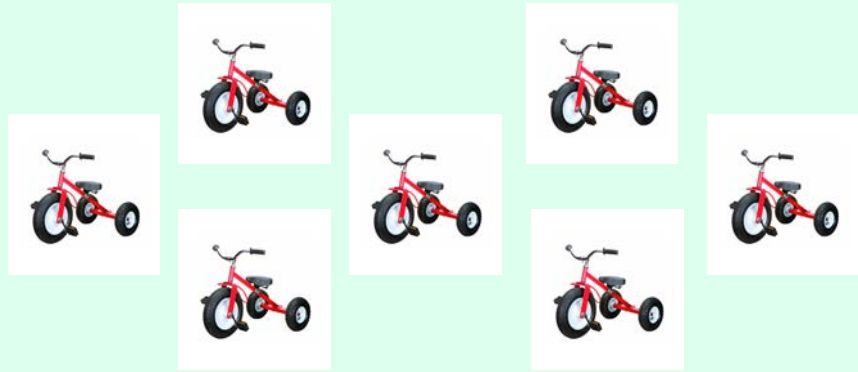

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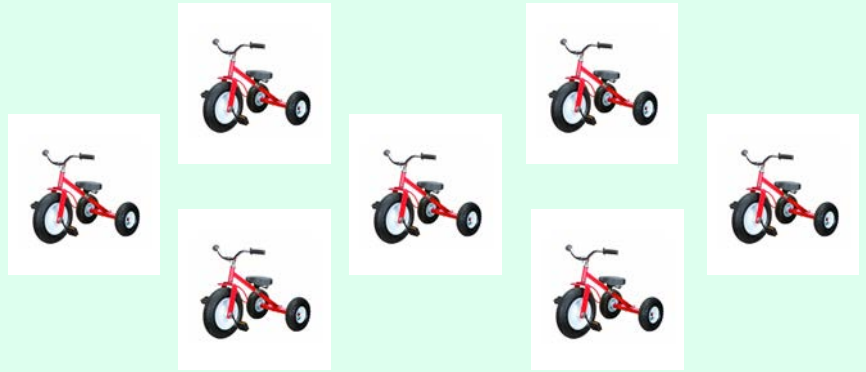

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HOW A
HOW AR

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?
?

an example

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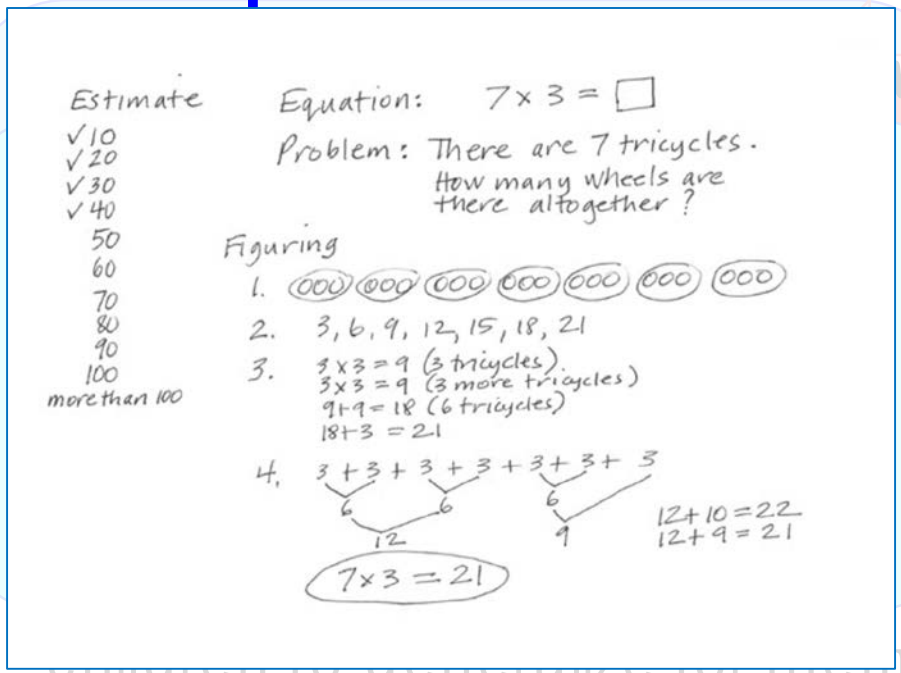

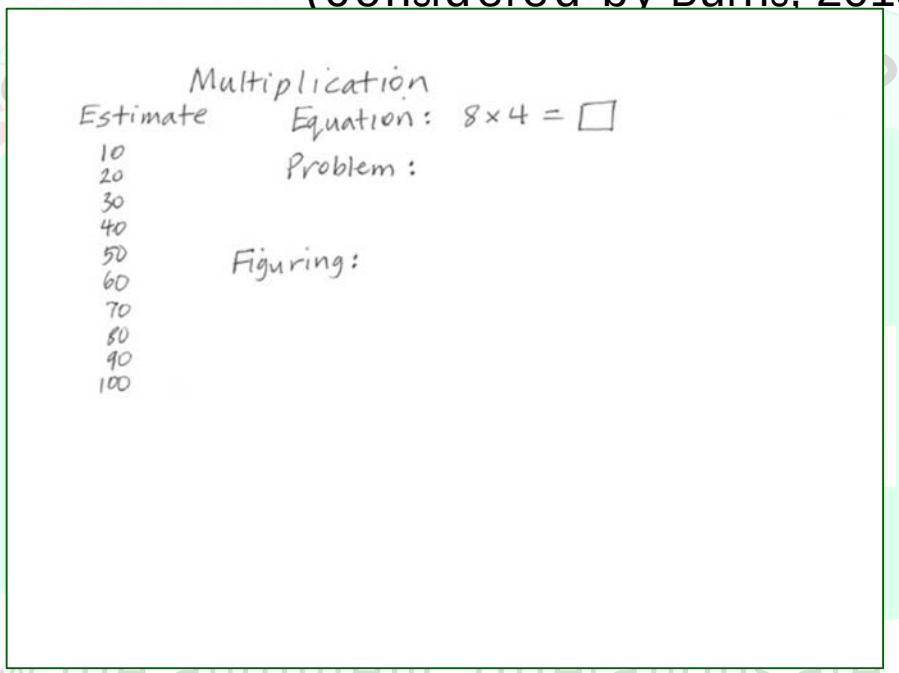

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WHAT ARE WE TEACHING?
WHAT ARE THEY LEARNING?

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7 x 3 = ?

Practising with problems after problems, focusing on the mathematical procedures connecting with the words!?

mathematical world

(re[illegible]-world

- "children to generalize for themselves ... [illegible] are observed in the language of the real world"
- children to "make sense of situations numerically" (Burns, 2007, p. 14)

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BEYOND WORD PROBLEMS

another example

(provided by Burns, 2007, p. 17)

1. If A = $0.01, B = $0.02, C = $0.03, and so on, what is the value of your first name?
2. Using this alphabet system, one of the days of the week is worth exactly $1.00. Which one is it?
3. Find other words that are worth exactly $1.00.

approaches, strategies, … working habits, different kinds of reasoning, …

a lot of arithmetic practice

➔ **mainly concerned with PROBLEM SOLVING on top of COMPUTATION**

Word Problems

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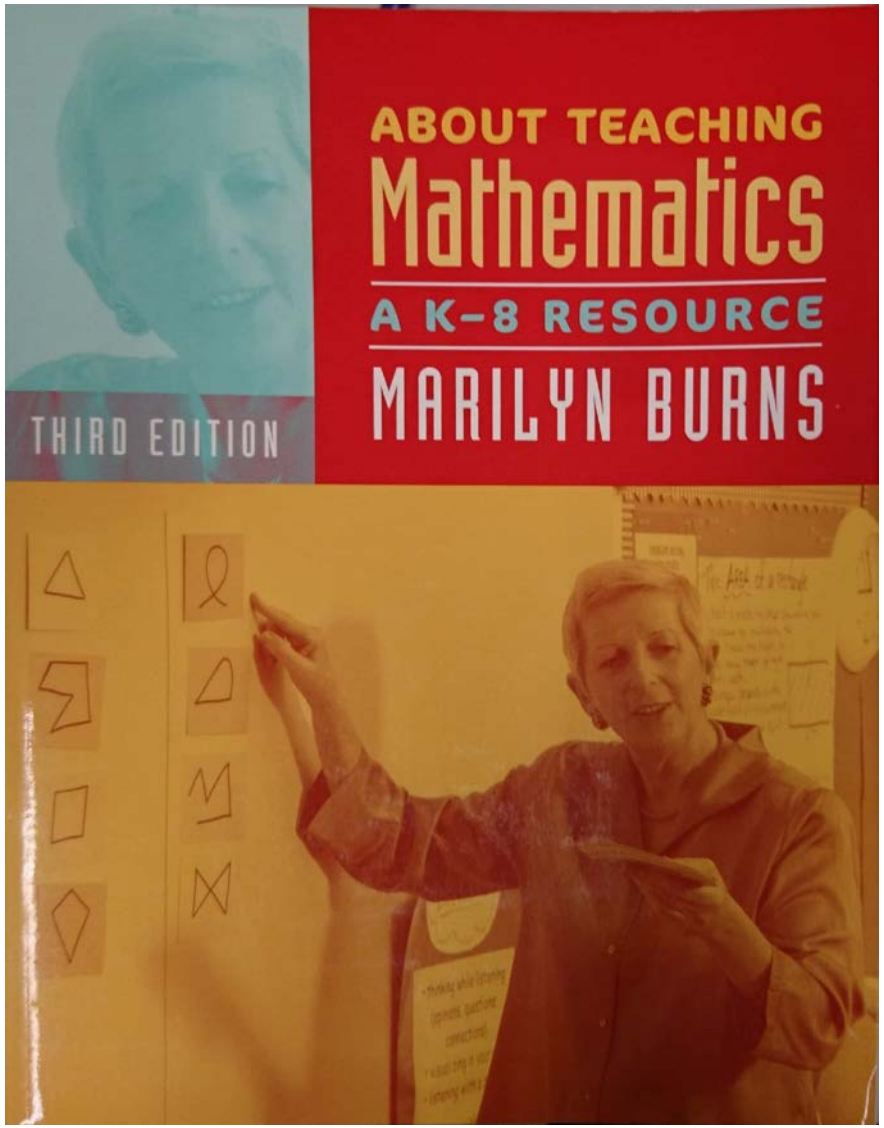
my conceptual picture of how Burns' suggestions work in learning & teaching of mathematical word problems

ABOUT TEACHING MATHEMATICS



Burns, M. (2007). *About teaching mathematics: A K-8 resource (3rd Edn.)*. Sausalito, CA: Math Solutions Publications.

WORD PROBLEMS

So much a headache that cannot be resolved easily!

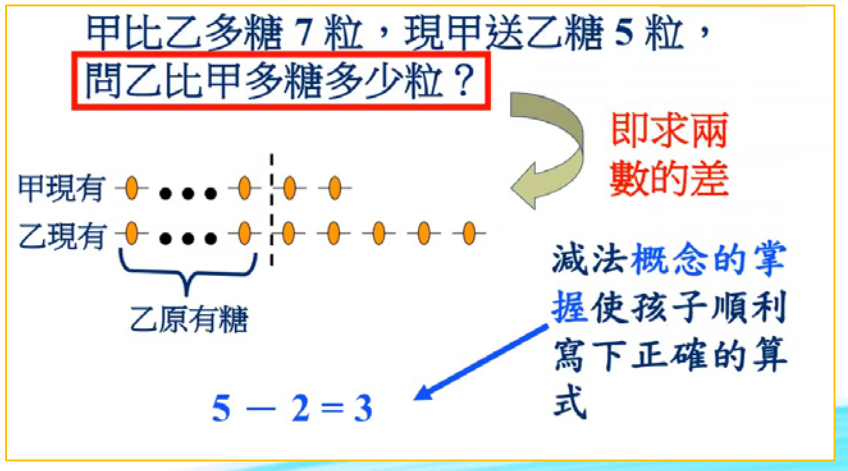
… the above sharing is mostly based on

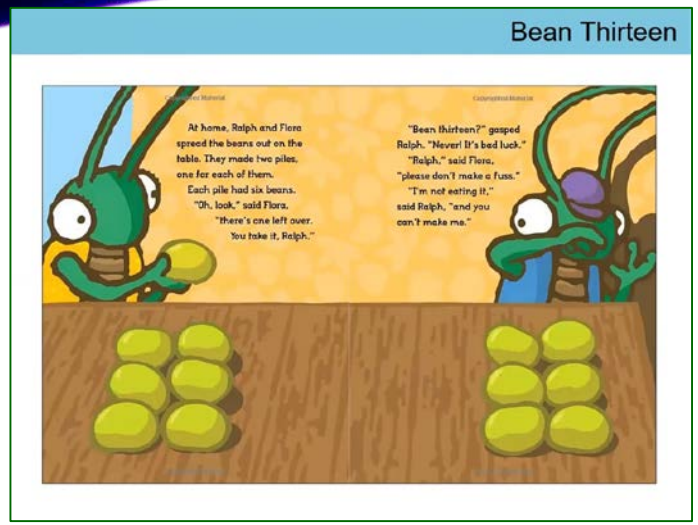
MY Reading of Marilyn Burns

WORD PROBLEMS

YOUR Reading of the strategies and approaches suggested here ... under different pedagogical themes

How would you understand them?





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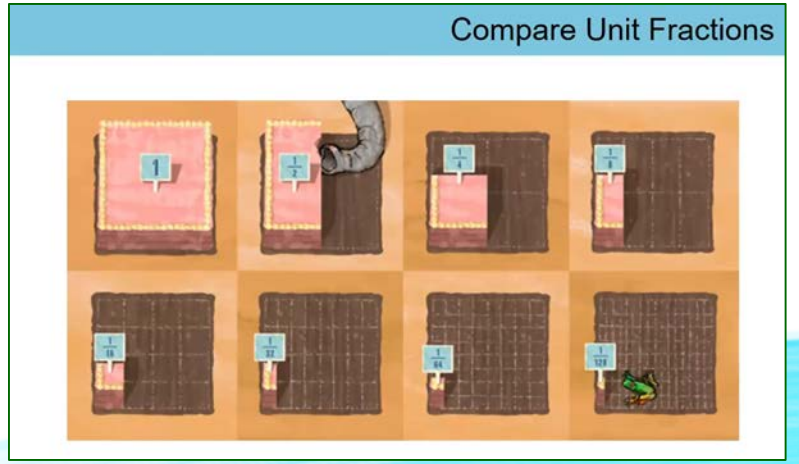

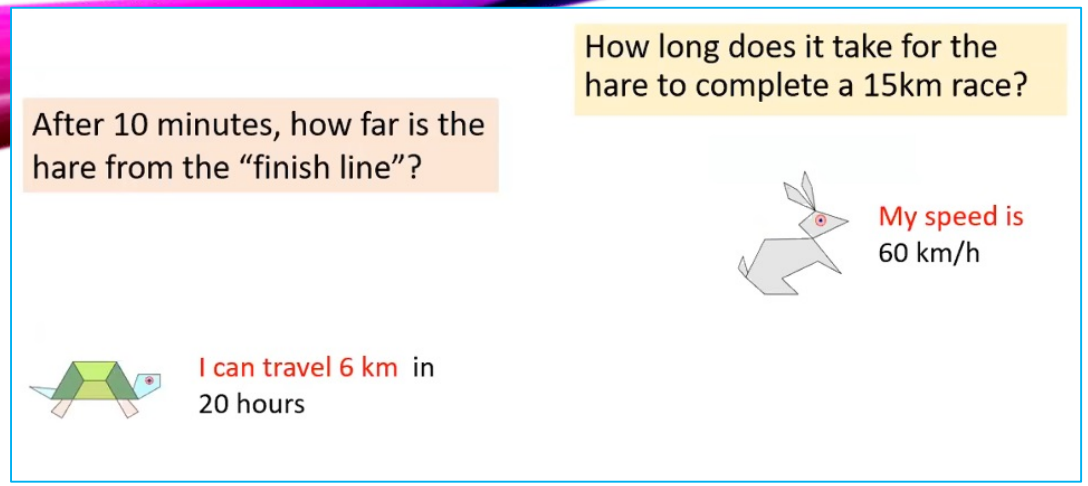

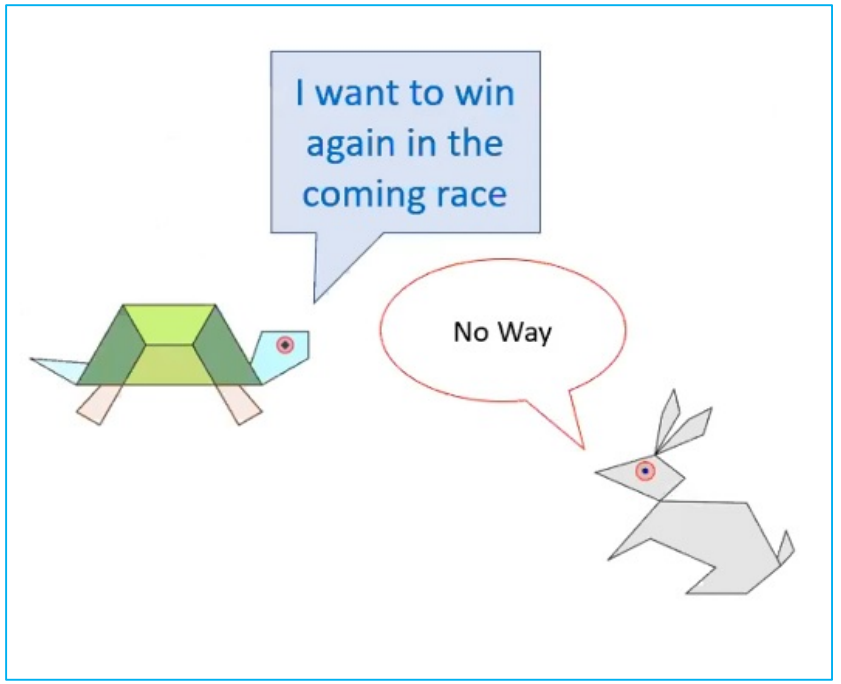

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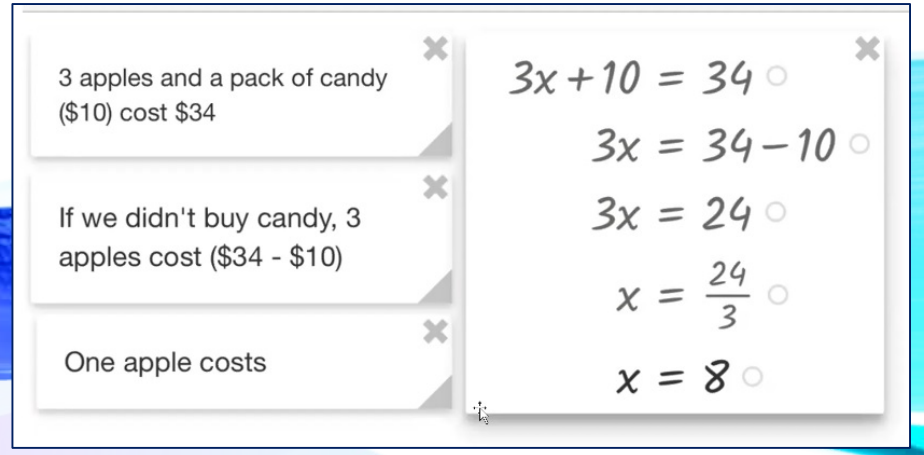

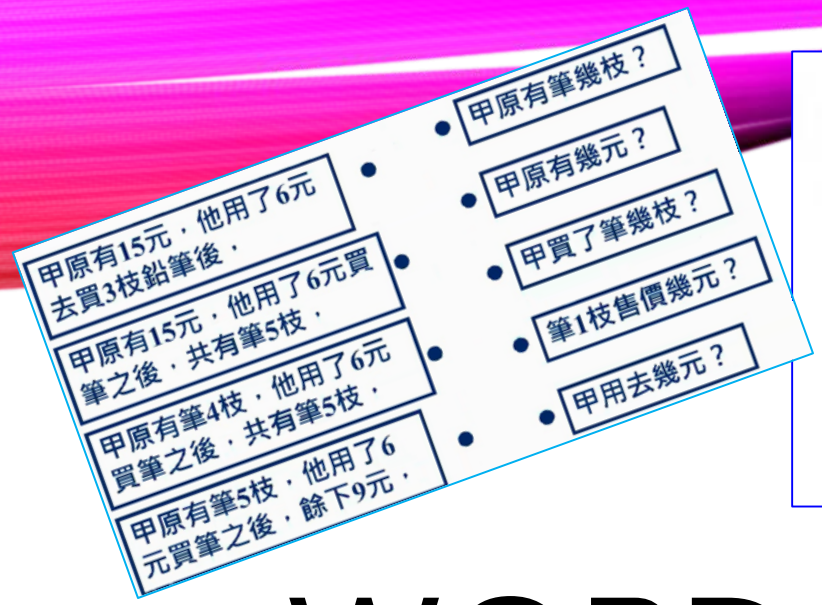

2. 認真閱讀題目，找出不能回答問題的原因，把代表原因的英文字母圈起來。

A. 「資料」不足
B. 「資料」與「問句」沒有關係
C. 沒有「問句」

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writing / posing their own word problems